REMARKS

No new claims have been added. Claim 39 has been canceled. Claims 19, 24, 29 and 41-43 have been amended. Accordingly, claims 19, 20, 22-38 and 41-43 remain under prosecution in this application.

In the Drawings

The Examiner expressed some confusion as to the interplay between brake lining 5 as shown in Figure 1 of the drawings and the contacting surface between elements 14 and 15. The Examiner also noted that Figure 1 included two different drawings. The undersigned has closely reviewed the figures, the specification, and the claims and the undersigned has amended the verbiage in the specification, claims and Abstract to be internally consistent. For example, the specification, at times used the phrase "brake lining 5" to, in fact, refer to friction surface 14. Still in other instances, "brake lining 5" was generically used to refer to the entire brake pad which consists of carrier plate 15, friction surface 14, and, depending on the embodiment, shackle 13. Because the specification was not always consistent in the use of this terminology, it lead to much of the Examiner's confusion. Accordingly, revisions to the drawings and the specification are submitted herewith setting forth consistent language and reference numerals. Specifically, "brake pad 5" is now specifically defined as including friction lining 14 and carrier plate 15 (see paragraph 0017). In some claim embodiments, carrier plate 15 further includes shackle 13. The undersigned believes with these corrections made throughout the drawings, specification, claims, and Abstract, most, if not all, of the Examiner's confusion should be eliminated.

In the Specification

As was mentioned immediately above, the specification has been amended throughout to make consistent use and application of the terms "brake pad", "friction lining", and "carrier plate". Because the changes are extensive, submitted herewith is a second substitute specification, both in marked up and clean format. No new subject matter has been added.

The Brief Description of the Drawings portion of the substitute specification has also been amended to track changes made to the drawings.

Claim Objections

Claims 19, 20, 22-39, 41, 42 and 43 are objected to because of various informalities set forth by the Examiner in detail. The undersigned has closely reviewed each of the informalities cited by the Examiner and has made the appropriate amendment to the appropriate claims. The undersigned believes that the amendments made to the claims in response to the Examiner's claimed objections speak for themselves and a detailed explanation of each amendment is unnecessary.

35 USC §112, second paragraph

Claims 19, 20, 22-38, 41, 42, and 43 are rejected under 35 USC §112, second paragraph as being indefinite. Specifically, the phrase "arranged with respect to the central plane", as found in claim 19 is objected to by the Examiner as being indefinite. It is unclear to the Examiner how the spring assembly is arranged with respect to the central plane of the brake housing. The undersigned has amended this portion of claim 19 (along with parallel portions of claims 41, 42, and 43), to now read "wherein the spring assembly is arranged against said brake pad such that it precludes an unsymmetrical load on the brake pad. . ." The undersigned believes that this is an accurate functional recitation of the placement of the spring assembly and support is found in paragraph 21 of the second substitute specification (clean copy) for this recitation.

The phrase "an indentation" in the 18th line from the bottom of claim 41 was rejected as indefinite. The Examiner was not sure whether this "indentation" was the same as the "groove shaped indentations" introduced earlier in the claim. The undersigned has reviewed claim 41 and has amended the latter "indentation" to, in fact, be one in the same as the earlier introduced "grooved shaped indentations."

The Examiner cited various instances in claims 29, 41, 42, and 43 of indefiniteness. The undersigned has closely reviewed each and every one of the instances set out on page 4, paragraph 7 of the office action and has amended the pertinent claims to overcome the rejections. Because the undersigned believes that the various amendment speak for themselves, in view of the Examiner's indefiniteness rejection, the undersigned does not believe that a detailed explanation of each amendment is beneficial or necessary.

35 USC §102

Claims 19, 20, 22, 23, 25, 37, 38 and 39 are rejected under 35 USC §102 as being anticipated by WIPO-98/00647. Claim 19 has amended herein to include the feature of the spring assembly "being supported on the first brake lining in a circumferential direction particularly between two actuating devices." None of the references of record teach or suggest the invention set forth in claim 19 and accordingly, the undersigned believes that claim 19 and its dependent claims are now in condition for allowance.

Claims 41-43

Claims 41-43 have been amended (as discussed above) to overcome the rejections under 35 USC§112, second paragraph as set forth in the most recent office action. Because none of the references of record teach or suggest the invention set forth in each of these three claims, the undersigned believes that they are now in condition for allowance.

Applicant believes no fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 18-0013, under Order No. (AP9974)64098-0878 from which the undersigned is authorized to draw.

Dated: September 24, 2003

Respectfully submitted,

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Attachments

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AP9974

Spot-type Disc Brake with a Spring Assembly for a Brake Pad ~~Lining~~

sub spec approved by Examiner MB 10/15/03

Technical Field

[0001] The present invention generally relates to vehicle brakes, and more particularly relates to a spot-type disc brake with a spring assembly for the active adjustment of a clearance between a brake pad ~~lining~~ and a brake disc.

Background of The Invention

[0002] DE 31 30 185 A1 discloses a disc brake with resetting springs. The disc brake includes two resetting springs spaced in a circumferential direction and abutting with free spring legs on brake pads ~~linings~~ arranged on either side of the brake disc. The brake pads ~~linings~~ are lifted from the brake disc after a brake operation due to the spreading effect of the spring legs. The springs are compressed between a brake holder, a brake caliper and the brake pads ~~linings~~ in a first assembly. The resetting springs are anchored only insufficiently in the disc brake so that the resetting springs may easily be detached and lost, especially when exposed to vibrations. In a second design, the resetting springs are screwed to the disc brake. However, this necessitates an undesirable additional fastening means for each resetting spring. In addition, the use of two resetting springs basically involves the risk that in the event of failure of one of the resetting springs there will occur an inclined position of a brake pad ~~lining~~ which impairs functioning.

[0003] In view of the above, an object of the present invention is to disclose a spot-type disc brake with a spring assembly for the clearance adjustment at one brake pad ~~lining~~ , which overcomes the shortcomings known from the state of the art and, in addition, is easy to handle.

[0004] This object of the present invention is achieved by a spot-type disc brake assembly which includes a brake housing straddling a brake disc, with at least one brake pad ~~lining~~ that

is arranged in the brake housing so as to be slidable in the actuating direction and cooperates tribologically with the brake disc upon brake application. At least one actuating device to apply an actuating force to the brake pad ~~lining~~ is incorporated in the brake housing. To adjust a clearance between the brake pad ~~lining~~ and the brake disc upon termination of brake application, the spot-type disc brake includes a spring assembly which comprises exactly one spring that is secured detachably to the spot-type disc brake and is supported on the brake pad ~~lining~~ , on the one hand, and on the brake housing, on the other hand. In particular the detachable attachment of the spring on a brake housing permits an especially simple manipulation of the subassembly composed of brake housing, brake pad ~~lining~~ , and spring. Also, the spring is easy to mount and dismount.

[0005] An advantageous embodiment of the spot-type disc brake is achieved in that the spring extends substantially in the central plane of the brake housing with respect to the circumferential direction of the brake disc. Thus, an undesirable inclined positioning of the brake pad ~~lining~~ is avoided even in the extremely unlikely case of failure of the spring. In any case, the general braking function will not be impaired, not even when such a failure occurs.

[0006] A preferred variation of the spot-type disc brake is achieved when the spring is supported on a brake pad ~~lining~~ which directly cooperates with at least one actuating device. This relates to spot-type disc brakes both in a fixed-type caliper and a floating-caliper construction, with a floating-caliper disc brake including a corresponding actuating device only on one side of the brake disc. The action of the spring directed to the brake pad ~~lining~~ close to the actuating device has a particularly positive effect on the clearance adjustment.

[0007] To facilitate the ability of mounting and dismounting of the spring, it may be provided that the spring with a first end portion is inserted into an accommodation recess at the brake pad ~~lining~~ . The end portion of the spring is fixed within the accommodation recess so as to prevent the end portion from slipping out of the accommodation recess. Above all in arrangements of the spot-type disc brake wherein two or more actuating devices apply a brake force to the brake pad ~~lining~~ , it is appropriate that the first end portion of the spring is

supported in a circumferential direction between two actuating devices on the brake pad ~~lining~~ . This achieves a symmetrical application of the spring force to the brake pad ~~lining~~ and prevents an inclined positioning of brake pads ~~linings~~.

[0008] In an expedient embodiment, the spring is configured as a tension spring that is suspended with a second end portion on the brake housing. A tension spring of this type is a standard component permitting low-cost application in the spring assembly of the present invention. The tension spring is preferably made of helical wire and suspended with a second end portion in a brake housing bore, for example. According to an alternative variation, the spring may of course also be designed as a compression spring which is detachably fastened on the brake housing.

[0009] Another favorable spring variation is achieved because the spring is configured as a spiral leg spring which is detachably fastened with a second end portion on the brake housing and acts as a bending spring. Above all, such a leg spring necessitates little mounting space and can be adapted flexibly to any respective installation specifications by simple shaping measures at its free ends. More particularly, the spring legs are configured in conformity with the preset supporting points on the brake housing or on the brake pad ~~lining~~ . It is suitable above all in this connection that at least one spring portion is shaped at the spring and supported on the brake housing in a circumferential direction. This improves anchoring of the spring on the brake housing, and lateral tilting of the spring with respect to the circumferential direction is prevented.

Brief Description of The Drawings

[0010] Figure 1 shows ~~two views of~~ a spot-type disc brake with a spring assembly of the present invention for clearance adjustment including ~~comprising~~ a tension spring.

[0011] Figure 2 is a partial cross sectional view taken through lines 2-2 of Figure 1.

[0012] Figure [2]3A shows ~~two views of~~ a spot-type disc brake with a second embodiment of the leg spring of the present invention ~~for clearance adjustment~~.

[0013] Figure 3B shows, in isolation, the leg spring of Figure 3A.

[0014] Figures [3]4A and 4B shows ~~two partial views~~ (top and side) views of an improved spring assembly with a ~~second~~ third embodiment ~~design~~ of the leg spring of the present invention.

[0015] Figure [4]5 is a partial view of a spring assembly with a ~~third~~ fourth embodiment ~~design~~ of the leg spring of the present invention.

[0016] Figures 6A and 6B [5]shows two views top and side of a spot-type disc brake with a fifth embodiment ~~another design~~ of the leg spring of the present invention ~~assembly~~.

Detailed Description of The Preferred Embodiments

[0017] The spot-type disc brake 1 of an automotive vehicle shown in the Figures comprises a brake holder 2 mounted fast on the vehicle and a brake housing 3 slidably mounted on the brake holder 2. More particularly, housing 3 is designed as a brake caliper straddling a brake disc (not shown). On one side of the brake disc, the brake housing 3 includes at least one actuating device 4 for the application of brake pads ~~linings~~ 5, 6 arranged on either side of the brake disc. Each brake pad 5, 6 includes a friction lining 14 and a carrier plate 15. During a brake application, a first brake pad ~~lining~~ 5 is applied by the actuating device 4 directly and a second brake pad ~~lining~~ 6 is pressed due to an axial shift of the brake housing 3 indirectly against the brake disc. In the Figures, embodiments of the brake housing with two actuating devices 4 are shown which are designed as a hydraulic piston-and-cylinder unit. It is of course also possible to use pneumatically, electrically, or mechanically acting actuating devices 4.

[0018] The ~~Besides, the~~ embodiment of the spot-type disc brake 1 according to the present invention is not limited to the arrangement of a defined number of actuating devices 4 in the brake housing 3. The brake pads ~~linings~~ 5, 6 arranged on either side of the brake disc are straddled by the brake housing 3 in a caliper-like fashion and are slidably supported on holding arms 7 projecting over the brake disc for the purpose of transmitting circumferential brake forces. Further, the brake pads ~~linings~~ 5, 6 are detachably connected to the actuating device 4, on the one hand, and to the axially outward leg of the brake housing, on the other hand.

[0019] To adjust a sufficient clearance between the brake pads ~~linings~~ 5, 6 and the brake disc after a braking operation or brake application, there is provision of a spring assembly which actively lifts the brake pad ~~lining~~ 5 from the brake disc after brake application. This prevents a friction contact between the brake pad ~~lining~~ 5 and the brake disc outside the braking phases and the resulting development of residual brake torques. This also prevents an uneven abrasion of material from the brake disc, frequently in the type of local brake washouts. In the embodiments of the spot-type disc brake according to the Figures, the spring assembly acts on one side on the first brake pad ~~lining~~ 5 which is directly coupled to at least one actuating device 4. The second axially outward brake pad ~~lining~~ 6 is usually anchored axially on the brake housing 3 and lifted from the brake disc during continued travel, either due to an axial shift of the brake housing 3 or uneven rotations of the brake disc, e.g., brake disc eccentricity. As an alternative, it is also possible to have the spring assembly act also on brake pads ~~linings~~ 5, 6 on both sides of the brake disc. For the symmetrical spring load on the brake pad ~~lining~~ 5, it is advisable to arrange the spring assembly with respect to the circumferential direction 9 of the brake disc substantially in the central plane 10 or plane of symmetry of the brake housing 3, that means, between the two actuating devices 4.

[0020] Figures 1 and 2 show ~~1 shows~~ a first design of the spring assembly with a wound tension spring 8 which, with a first spring end 11, is attached to the carrier plate 15 ~~brake lining 5~~ and, with a second spring end 12, is attached to the brake housing 3. The first spring end 11 is preferably hooked detachably at a shackle 13 on the carrier plate 15 ~~brake lining 5~~, the [said] shackle being fastened to ~~shaped on the~~ a side of the carrier plate 15 ~~brake lining 5~~ remote from the friction lining 14. Especially, the shackle 13 is secured to the back side of a carrier plate 15, the front side of which carries the friction lining 14. The second spring end 12 is hooked into a bore 16 or other indentation in the brake housing 3 and thus fixed in a detachable manner. However, still other appropriate fastening means are possible for the detachable fixation of the two spring ends 11, 12. The first spring end 11 is secured to the carrier plate 15 ~~brake lining 5~~ so that the point of force application of the tension spring 8 on the carrier plate 15 ~~brake lining 5~~ radially overlaps the force contact area of the actuating

devices 4 on the brake pad ~~lining~~ 5. The result is that a spring force is exerted on the ~~brake~~ friction lining [5]14 (through the carrier plate 15) and actively lifts the actuating devices 4 from the brake disc after brake application. Additionally, the point of force application is chosen so as to prevent an inclined positioning of the carrier plate 15 ~~brake lining 5~~ with respect to the friction surface of the brake disc. Further, the tension spring 8 ensures the clearance-free abutment of the carrier plate 15 ~~brake lining 5~~ on the actuating device 4, for example, a brake piston. The actual spiral-type wound tension spring 8 abuts in a protected fashion on the brake housing 3 in an indentation 17 between the actuating devices 4. Consequently, the tension spring does not straddle the brake disc and is hence unaffected by the brake disc rotation. Similar to the design as a tension spring 8, a compression spring is also possible for the adjustment of a clearance.

[0021] Figures 3A and 3B show ~~2 shows~~ a second embodiment of the spring assembly for the clearance adjustment with a bending spring that is configured as a wound leg spring 18 that straddles the brake disc. As has already been described hereinabove, the leg spring 18 is arranged substantially in the central plane 10 of the brake housing 3 to preclude an unsymmetrical spring load on the carrier plate 15 ~~brake lining 5~~. This prevents an undesirable inclined positioning of the brake pad ~~lining~~ 5. In detail, the leg spring 18 is arranged in a recess 19 between two bridge portions 20 of the brake housing 3. With its first leg 21, the leg spring 18 is suspended on a shackle 23 fastened at the brake pad ~~lining~~ 5. To this end, the first leg 21 includes at its free end appropriate bent spring portions 24 to permit ease of mounting the spring leg 21 at the shackle 23, on the one hand, and to prevent the spring leg 21 from slipping out of the shackle 23, on the other hand. The second leg 22 of the leg spring 18 is supported within the recess 19 on the brake housing 3. As mentioned before, the brake pad ~~lining~~ 5 is centrally acted upon by spring force also in this case so that an undesirable inclined positioning of brake pads ~~linings~~ will not occur. In this arrangement, the spring force points away from the brake disc.

[0022] Figures 4A and 4B show, ~~3 shows~~ in two views, an embodiment of the spring assembly for the clearance adjustment with an improved leg spring 25. The first leg 21 of the

leg spring 25 is suspended with free, bent spring portions 24 in the shackle 23 of the brake pad ~~lining~~ according to the embodiment of Figures 3A and 3B [2]. On the other hand, the second leg 22 is supported in a circumferential direction 9 on the brake housing 3 by means of two spring arms 26 which extend opposedly in a circumferential direction. Preferably, the opposing spring arms 26 are symmetrically supported in the recess 19. The support of the spring arms 26 within the recess 19 prevents a tilting movement of the leg spring 25 in a circumferential direction 9. This loss-proof hold of the leg spring 25 in the brake housing 3 is augmented by the support of the second leg 22 on the brake housing 3. To this end, two groove-shaped indentations 27, 28 are shaped radially on the top side or bottom side of the brake housing 3 adjacent to the recess 19 at brake housing 3. The indentations 27, 28 are shaped into the brake housing 3 e.g. by way of a machining operation. The indentations may also be shaped during casting of the brake housing 3 which is especially favorable for the manufacture. The second spring leg 22 abuts in these indentations 27, 28 with matingly configured fastening portions 29, 30, especially under spring bias. This improves the accurate positioning and hold of the leg spring 25 on the carrier plate 15 ~~brake housing 3~~.

[0023] Figure [4]5 illustrates another variation of a leg spring 31 with a simplified support of the second spring leg 22 on the brake housing 3. Only one indentation 27 is shaped at the radial bottom side of the brake housing 3 in which the associated fastening portion 29 of the leg spring 31 abuts. The support by way of the spring arms 26 which is lateral in a circumferential direction is maintained. In total, the leg spring 31 compared to the embodiment of Figure 3 can be designed in a simplified fashion with respect to the necessary bending deformations. As an alternative, the fastening portion 29' of the leg spring 31 can also be suspended into a bore 32 at the brake housing 3 in order to safely attach the leg spring 31 to the brake housing 3.

[0024] Figures 6A and 6B [5] illustrate[s] in two views another variation of the spring assembly, wherein the support of the leg spring 33 in a circumferential direction 9 is improved once more. The spring arms 26 extending in a circumferential direction 9 are arranged in a pocket 34 adjacent to the recess 19 and designed on the radial top side of the

brake housing 3. This renders it possible to [fix]retain the leg spring 33 not only in a circumferential direction 9 but also in a radially accurate positioning on the brake housing 3. In a way that is favorable under aspects of manufacturing technology, a pocket 34 of this type may also be shaped already during casting fabrication of the housing 3, with the result that there is no more need for machining. Further attachment of the leg spring 33 on the brake pad ~~lining~~ 5 or on the brake housing 3 is carried out in conformity with the other embodiments.

[0025] The actual active spring (8, 18, 25, 33) for the adjustment of clearances is favorably made of spring wire and, accordingly, can be adapted extremely flexibly to any respective installation specifications by means of simple bending operations. In addition, the spring (8, 18, 25, 33) can be made of sheet metal or any other suitable spring material.

[0026] The detachable securement of the spring (8, 18, 25, 33) on carrier plate 15 ~~the brake lining 5~~ is carried out at an appropriately designed accommodation recess, for example, a shackle (13, 23) according to the Figures. An accommodation recess of this type can be shaped directly [to] into ~~the brake lining 5 or~~ the carrier plate 15, or can be designed on a holding element 35. The ~~, roughly as in Figures 2 to 5. In these Figures, the~~ holding element 35 is composed of a sheet-metal strip 35 which is fastened to the carrier plate 15 and on which the shackle 23 is provided.

[0027] Basically, a spring assembly of the present invention for the adjustment of clearances was described by way of the Figures only in the example of spot-type disc brakes 1 of the floating-caliper type of construction. Of course, a spring assembly of this type permits being used also in fixed-caliper spot-type disc brakes.

AP9974

Spot-type Disc Brake with a Spring Assembly for a Brake Pad ~~Lining~~

Abstract of The Disclosure

[0028] The present invention relates to a spot-type disc brake with a brake housing straddling a brake disc, with at least one brake pad ~~lining~~ that is arranged in the brake housing so as to be slidable in the actuating direction and cooperates tribologically with the brake disc upon brake application, with at least one actuating device arranged in the brake housing to apply an actuating force to the brake pad ~~lining~~ , and with a spring assembly for the active adjustment of a clearance between the brake pad ~~lining~~ and the brake disc after brake application. To simplify the configuration of the spring assembly, the spring assembly comprises exactly one spring which is secured detachably in the spot-type disc brake and is supported on the brake pad ~~lining~~ and on the brake housing. A spring of this type is arranged advantageously symmetrically within the brake housing to prevent an undesirable inclined positioning of the brake pads ~~linings~~.